MECHANICAL STATISTICAL DEVICES.

In the *Abstract of the Proceedings of the Society of Arts for the Twenty-Seventh Year*, 1888–1889 (Boston), there is published an abstract of a paper read before the Society by Mr. Charles F. Pidgin of the Massachusetts Bureau of Labor, on *Statistical Tabulation by Machinery.* The following paragraphs relate to the development of the tabulating devices used in the work of the Massachusetts Bureau.

We are all familiar with the four perpendicular and one cross line to indicate five. In 1875 I prepared and copyrighted a "Self-Counting Tally Sheet." Upon these sheets the dots were already printed, and the tabulator, by encircling the dots and adding certain checks, could tabulate 9000 points on a sheet six by nine inches; and, what was of particular importance, could carry out the results at once, the sheets being so arranged as to "self-count" the check marks. The self-counting tally sheet was used to prepare the population and social statistics of the State Census of 1875. Seaton's tallying machine, used in the United States Census of 1880, was ingeniously arranged to receive the check marks in prepared columns, but it was not self-counting, and the aggregations were necessarily laborious and tedious. A tallying machine used in the Royal Bureau of Statistics at Rome has figures on the peripheries of wheels, and when these upturned figures are inked with a printer's roller, impressions may be taken on paper for use as bulletins. In 1882 I used, for the first time, a mechanical device for tallying or counting. This was named the "Pascal" counting machine. It registers from 1 to 999, and beyond that, by an ingenious device, its capacity may be indefinitely extended. The single machine is intended to count one at a time only. By combination of a number of machines the series may be used for addition or multiplication.

The Pascal machine is the foundation of the "Automatic Door Counting Machine," by means of which the population and social statistics of the Massachusetts State Census of 1885 were prepared. By this machine a great gain is made over previous methods, both in speed and accuracy. With the old form of tabulation sheet but three points of statistical information were secured at a time, while the machine referred to has a capacity of 144 points at one handling of the schedules. Its efficiency is from five to twenty times that of the old methods of tabulation.

For addition both printed and mechanical devices are used. The printed one is called "Self-Counting Form, for Adding Values,

Quantities, and Numbers." This form, based upon the decimal disintegration of numbers, was used in aggregating the Industrial Statistics of the Massachusetts Census of 1875. It supplies a means of adding, paradoxical as it may seem, without the use of figures. To add "50,000," "100.000," or even "1,000,000," requires but one check on the sheet. The electrical adding machine is based upon this invention.

In 1882 mechanical adding machines were introduced into the Bureau. The first one used was the Pascal counter, used in a series. To secure the total required a peculiar result slip and some little time to add the respective columns of results. To overcome this delay a new machine, called "The Billionaire," was invented, which gave a continuous total easily read by a glance at the dial-plate. In this machine the "carrying" device was controlled by the eye, its action not being automatic. The next invention was the "Cylinder Adding Machine," in which the ear, or sound, was relied upon to govern the carrying device, and it was a material advance upon the Billionaire. The succeeding improvement was the "Button" machine, in which "touch" took the place of eye or ear, and was found to be more efficacious than its predecessors.

There is an intermediary process between counting one at a time and the addition of *large* numbers. This is the addition of *small* numbers, running from 2 to 50, or even 100. To do this kind of work expeditiously the "Rotary Counting Machine" was invented. By its use such small numbers can be added automatically, no attention being required by the carrying device. The capacity is 25,000, and it is small enough to be carried in the pocket.

The speaker next referred to his "Electrical Adding Machine." This machine is based upon the decimal disintegration of numbers, — the same principle as was made use of in constructing the "Self-Counting Form for Adding Values, Quantities, and Numbers." The capacity of the machine likely to be most used is 999,999,999, but the capacity may be easily extended indefinitely. Machines can be easily constructed on this plan to add yards, feet, and inches; pounds, shillings, pence, and farthings; fractions,— in fact, any collocation of units, the machine doing the necessary reductions automatically, and showing a consecutive total on a dial plate.

With a view of inventing a machine, or rather a system, which would give the same opportunities for addition as the Automatic Door Counting Machine does for tallying, I devised the "Chip System." The chips are contained in a case, and are taken from it the same as a compositor selects type when "setting." By the use of variously colored "chips," and a machine with 36 compartments, a clerk can add 144 points at once,— that is, have 144 different sums in addition going on at the same time, with 144 results when the "chipping" is completed. The chips are put back in the cases, and used over and over again.

For the figuring of percentages Thatcher's machine has been used, but it does not give enough decimal places for advanced statistical work. The speaker's "Addition Percentage Tables" reduce the figuring of percentages to simple addition, with decimals carried to the seventh place.

MINOR NOTICES.

Report on the Custody and Condition of the Public Records of Parishes, Towns, and Counties. (Massachusetts). By Carroll D. Wright, Commissioner. Boston. 1889. Pp. li, 379.

This work will naturally be of great assistance to students desirous to learn what official records are in existence in Massachusetts towns. Information is also given concerning the state of preservation of such records. The list extends to the enumeration of proprietors, church, town, and county records. Considering the lack of official data in the line of religious statistics, the lists of churches, existing and extinct, with date of organization and denomination, will be of interest. From a table on page xxxi it appears that there are 2060 churches in the state.

Annual Report of the Supervising Surgeon-General of the Marine-Hospital Service of the United States for the fiscal year 1888. Washington. Pp. 406.

Besides the regular statistical tables of the marine-hospital service, there is published in this volume a paper entitled "Studies in service statistics: pneumonia, syphilis, and typhoid fever," in which a statistical analysis is made of 45,118 cases of syphilis; 1649 of pneumonia, and 1637 of enteric fever.